CLAIMS

1. A weighted vector error echo canceller comprising:

an adaptive echo canceller filter having an input adapted to receive a transmit signal, the adaptive echo canceller filter being adapted to generate a signal representative of an echo signal associated with the transmit signal, wherein the adaptive echo canceller filter functions at a transmit rate; and

an interpolation filter bank having an input adapted to receive the representative signal, the interpolation filter being adapted to generate a filtered output vector at a plurality of branches, wherein the filtered output vector is subtracted from a receive signal vector for generating a residual echo vector and wherein the plurality of branches corresponds to the receive signal vector.

2. The echo canceller of claim 1, further comprising

an error weighting multi-input-multi-output filter having an input adapted to receive the residual echo vector, the error weighting multi-input-multi-output filter being adapted to generate a weighted error vector for training the adaptive echo canceller filter.

3. The echo canceller of claim 1, wherein the adaptive echo canceller filter is a finite impulse response filter.

4. The echo canceller of claim 1, further comprising a reference signal interpolation filter having an input adapted to receive a transmit signal, the reference signal interpolation filter being adapted to generate a reference signal vector.

5. The echo canceller of claim 1, further comprising a vectorization unit having an input adapted to receive an input signal from an analog front end, the vectorization unit being adapted to generate a receive signal vector.

6. The echo canceller of claim 5, wherein the vectorization unit further comprising at least one delay unit for delaying the input signal by a predetermined number of samples.

7. The echo canceller of claim 5, wherein the vectorization unit further comprising at least one down sampling block for decimating the input signal by a predetermined factor.

8. The echo canceller of claim 1, wherein training functionality associated with the adaptive echo canceller filter functions at the transmit rate.

9. The echo canceller of claim 1, wherein updating functionality associated with the adaptive echo canceller filter functions at the transmit rate.

10. The echo canceller of claim 8, wherein the training functionality involves adapting a plurality of coefficients of the adaptive echo canceller filter based on at least one of a plurality of up sampled reference signal vectors and weighted error signal vectors.

11. A method for implementing a weighted vector error echo canceller, the method comprising the steps of:

receiving a transmit signal;

generating a signal representative of an echo signal associated with the transmit signal at a transmit rate;

receiving the representative signal; and

generating a filtered output vector at a plurality of branches, wherein the filtered output vector is subtracted from a receive signal vector for generating a residual echo vector and wherein the plurality of branches corresponds to the receive signal vector.

12. The method of claim 11, further comprising the steps of:

receiving the residual echo vector;

generating a weighted error vector for training an adaptive echo canceller filter.

13. The method of claim 11, wherein the adaptive echo canceller filter is a finite impulse response filter.

14. The method of claim 11, further comprising the step of:

generating a reference signal vector.

15. The method of claim 11, further comprising the steps of:

receiving an input signal from an analog front end; and

generating a receive signal vector.

16. The method of claim 15, further comprising the step of:

delaying the input signal by a predetermined number of samples.

17. The method of claim 15, further comprising the step of:

decimating the input signal by a predetermined factor.

18. The method of claim 11, wherein training functionality associated with the adaptive echo canceller filter functions at the transmit rate.

19. The method of claim 11, wherein updating functionality associated with the adaptive echo canceller filter functions at the transmit rate.

20. The method of claim 18, further comprising the step of:

adapting a plurality of coefficients of the adaptive echo canceller filter based on at least one of a plurality of up sampled reference sequences and weighted error signal.

21. The echo canceller of claim 1, wherein a least mean square update rule is applied to train at least one coefficient of the echo canceller filter, the least means square update rule is defined as

$$\mathbf{w}_{n+1} = \mathbf{w}_n - \frac{\mu_n}{2}\frac{\partial e_n^T e_n}{\partial w_n}$$

$$= \mathbf{w}_n + \mu_n \left[\mathbf{X}_n^T\mathbf{F}^T \mid \uparrow \mid \mathbf{X}^T_{n-K+1}\mathbf{F}^T\right] \cdot \mathbf{H}^T \cdot \mathbf{e}_n.$$

where $\mathbf{w}$ represents a coefficient vector, μ represents step size, e represents the error signal, $\mathbf{e}$ represents a weighted error vector, $\mathbf{X}$ represents a transmit signal matrix, $\mathbf{F}$ represents an interpolation filter bank matrix and $\mathbf{H}$ represents a Toeplitz matrix.

22. The echo canceller of claim 1, wherein a least mean square update rule is applied to train at least one coefficient of the echo canceller filter, the least means square update rule is defined as

$$\mathbf{w}_{n+1} = \mathbf{w}_n + \mu_n \mathbf{S}_n \mathbf{e}_n.$$

where **w** represents a coefficient vector, μ represents step size, **S** represents a reference filter vector, and **e** represents a weighted error vector.

23. The method of claim 11, wherein a least mean square update rule is applied to train at least one coefficient of the echo canceller filter, the least means square update rule is defined as

$$\mathbf{w}_{n+1} = \mathbf{w}_n - \frac{\mu_n}{2} \frac{\partial e_n^T e_n}{\partial w_n}$$

$$= \mathbf{w}_n + \mu_n \left[\mathbf{X}_n^T \mathbf{F}^T \mid \uparrow \mid \mathbf{X}^T_{n-K+1} \mathbf{F}^T\right] \cdot \mathbf{H}^T \cdot \mathbf{e}_n.$$

where **w** represents a coefficient vector, μ represents step size, e represents the error signal, **e** represents a weighted error vector, **X** represents a transmit signal matrix, **F** represents an interpolation filter bank matrix and **H** represents a Toeplitz matrix.

24. The method of claim 11, wherein a least mean square update rule is applied to train at least one coefficient of the echo canceller filter, the least means square update rule is defined as

$$\mathbf{w}_{n+1} = \mathbf{w}_n + \mu_n \mathbf{S}_n \mathbf{e}_n.$$

where **w** represents a coefficient vector, μ represents step size, **S** represents a reference filter vector, and **e** represents a weighted error vector.

25. The echo canceller of claim 1, wherein a steady state operation is supported by passing the residual echo vector to a receiver.

26. The method of claim 11, wherein a steady state operation is supported, further comprising the step of:

passing the residual echo vector to a receiver.